Botanical Sciences 99(4): 976-990. 2021
DOI: 10.17129/botsci.2889

Received: March 20, 2021, Accepted: April 26, 2021
On line first: August 21, 2021

Salvia gomezpompae (Lamiaceae), a new species from Veracruz, Mexico
Salvia gomezpompae (Lamiaceae), una especie nueva de Veracruz, México

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Abstract

Background: During a prospecting revision of *Salvia* collections at IEB, MEXU and XAL herbaria for Flora of Veracruz, undetermined specimens, or misidentified either as *S. nana* or *S. prunelloides*, not referable to any known species were identified.
Hypotheses: The morphological characters of these specimens match with those of *Salvia* subg. *Calosphace* sect. *Farinaceae* and support them as an undescribed species.
Taxon: Lamiaceae, *Salvia* sp. nov.
Study site: Central portion of the state of Veracruz.
Methods: Botanical explorations were conducted in the two general areas in which the putative new species has been recorded, new specimens were collected and prepared according to standard procedures. A thorough morphological examination was applied, and the hypothesis was tested contrasting the evidence against specialized taxonomic literature and specimens of the most similar species.
Results: *Salvia* sp. nov. is vegetatively almost identical to *S. nana* but lacks the diagnostic floral characters defining the group to which this species belongs, sect. *Uliginosae*. Floral characters rather match those of sect. *Farinaceae*, to which is assigned; between the species of this section, it is most similar to *S. oblongifolia* but clearly differs by vegetative characters (petiole length, absence of axillary leaves, leaf shape, size, pubescence and texture, as well as by having thickened veins).
Conclusions: Morphological and comparative examination contrasting with the species of *Salvia* justifies the recognition of a new *Salvia* species, which is here named as *Salvia gomezpompae* and properly described.
Keywords: Flora of Veracruz, Nagoya Protocol, Nepetoideae, *Salvia nana*, *Salvia nana 'Curling Waves'*, *Salvia oblongifolia*.

Resumen

Antecedentes: Durante una revisión prospectiva de las colecciones de *Salvia* en los herbarios IEB, MEXU y XAL para Flora de Veracruz, se encontraron especímenes no identificados, o confundidos con *S. nana* o *S. prunelloides*, que no concuerdan con alguna de las especies conocidas.
Hipótesis: Las características morfológicas de estos especímenes concuerdan con *Salvia* subg. *Calosphace* sect. *Farinaceae* y le sustentan como una especie no descrita.
Taxon: Lamiaceae, *Salvia* sp. nov.
Sitio de estudio: Porción central del estado de Veracruz.
Métodos: Se realizó exploración botánica en las dos áreas generales en que se ha registrado la presunta especie nueva, se colectaron y prepararon nuevos especímenes de acuerdo con procedimientos estándares. Se aplicó un examen morfológico exhaustivo, y la hipótesis fue contrastada con esta evidencia y frente a literatura taxonómica especializada y especímenes de las especies más similares.
Resultados: *Salvia* sp. nov. es vegetativamente casi idéntica a *S. nana* pero carece de los caracteres florales diagnósticos que definen el grupo al que pertenece, sect. *Uliginosae*. Los caracteres florales más bien concuerdan con aquellos de la sect. *Farinaceae*, a la que es asignada; entre las especies de esta sección, es más similar a *S. oblongifolia*, pero claramente difiere en caracteres vegetativos (longitud del peciolo, ausencia de fascículo de hojas axilares, forma, tamaño, pubescencia, textura y engrosamiento de venas en las hojas).
Conclusiones: El examen morfológico y comparativo de contraste con las especies de *Salvia* justifican reconocer una especie nueva, la que aquí se nombra como *Salvia gomezpompae* y es propiamente descrita.
Palabras clave: Flora de Veracruz, Nepetoideae, Protocolo de Nagoya, *Salvia nana*, *Salvia nana 'Curling Waves'*, *Salvia oblongifolia*.

The genus *Salvia* L. is listed among the most diverse genera of vascular plants (Frodin 2004) with about 1,000 spp. around the world (Walker *et al.* 2004, González-Gallegos *et al.* 2020a). It has a worldwide distribution, absent almost only from the coldest regions of high latitude or altitude (Harley *et al.* 2004). Most of the species are characterized by a well-known staminal lever mechanism, in which the stamens have an elongated connective flexibly attached to a relatively smaller filament, being activated as a lever that deposits pollen on pollinator's body when it tries to access the nectar at the bottom of the corolla (for a detailed description see Claßen-Bockhoff *et al.* 2003, 2004). Although this mechanism has appeared and has been lost several times along the evolutionary history of the genus, the basic pattern of a small filament with an elongated connective putting apart the two thecae has prevailed in most of the species (Walker & Sytsma 2007, Hu *et al.* 2018, Kriebel *et al.* 2020).

Salvia is classified into 11 subgenera, from which *Calosphace* (Benth.) Benth. is considered the most diverse with 580 species (Drew *et al.* 2017, Hu *et al.* 2018, Kriebel *et al.* 2019, González-Gallegos *et al.* 2020a). In America, this subgenus is distributed from the United States of America to northern Argentina and Chile, including the Caribbean islands, and it is the dominant lineage of *Salvia* in the continent (Epling 1939, González-Gallegos *et al.* 2020a). Mexico is considered the country with the highest richness with 295 species, of which 82 % are endemics (González-Gallegos *et al.* 2020a). Most of the Mexican species are present in coniferous and oak forests, although they are also found in tropical deciduous and sub-deciduous forests, as well as in arid zones (Ramamoorthy & Elliott 1998, Cornejo-Tenorio & Ibarra-Manríquez 2011).

Although the richness of *Salvia* in Mexico is fairly known (Martínez-Gordillo *et al.* 2017, González-Gallegos *et al.* 2020a), explorations carried out in recent years have led to the discovery of new species (Martínez-Ambriz *et al.* 2019, Bedolla-García *et al.* 2020, González-Gallegos *et al.* 2020b), therefore it is certain that we are far from having a definitive number yet. In addition, Regional Floras in the country have become a good instrument allowing a progressive advance in the knowledge and discovery of *Salvia* diversity, probably due to the stimulation of botanical explorations in remote or interesting areas, paired with a thorough examination and curation of the collections in key herbaria. Up to date, five major Floras have published taxonomic treatments of *Salvia*, and these altogether describe 177 species (about 30 % of the diversity in the country), 26 of these corresponding to new species published during the preparation of these projects (Table 1).

Aligned to the effective contributions through regional Floras, a revision of *Salvia* was recently started for Flora of Veracruz Project, which covers only the state of the same name. According to Martínez-Gordillo and collaborators (2017) there are 51 species for this state (ranking tenth in diversity), a number that could increase with the addition of previously undetected, and of new species. Currently, during prospecting examination of herbarium collections for this project, some specimens that clearly belonged to subgenus *Calosphace,* and did not match with any of the known species, were identified. Therefore, in order to test the hypothesis of these specimens constituting a new *Salvia* species, the specimens were analyzed, and the observations were also complemented with new material collected during October and December 2020. The evidence gathered and here reported supports the recognition of a new species, which is described, illustrated and diagnosed against the morphologically most similar species.

Materials and methods

Specimens of the new species and those similar were examined in the herbaria IEB, MEXU and XAL (acronyms according to Thiers 2021). Additionally, this was complemented with the examination and observations taken at the field during two botanical explorations addressed to the two general areas in which the new taxon thrives (cerro Teoxistle, Acultzingo, October 2020, and road between Cruz Blanca and Las Minas, December 2020). The new specimens collected were herborized and prepared according to standard procedures (Lot & Chiang 1986). Photographs of the habitat, habit, leaves and flowers were taken in the field. The samples were examined with the help of a Leica Stereo Zoom 5 and Zeiss Stemi 508 dissecting microscope and thoroughly analyzed with reference to specialized literature for identification (Epling 1939, 1940, Epling & Mathias 1957, Peterson 1978, Turner 2008).

Geographic coordinates were estimated for those specimens lacking these, or those with wrong or imprecise original coordinates. The estimations were made according to the recommendations given by Wieczorek (2001) and employing Google Earth Pro (2021). The complete matrix of specimens examined and their coordinates can be consulted in Table S1. GeoCAT (Bachman *et al.* 2011) online application was used to calculate Extent of Occurrence (EOO) and Area of Occupancy (AOO) for the conservation assessment.

Table 1. Contribution to the knowledge of Mexican *Salvia* provided by the development of regional Floras. Mexican states are abbreviated according to the code ISO 3166-2.

Publication	Area covered	Total species	New species	Reference
Flora of the Valley of Mexico	CMX, MEX and small portions of HID, MOR, PUE and TLA	31	1	Ramamoorthy 2001
Flora Mesoamericana	Central America and southeastern Mexico (CAM, CHP, TAB, ROO and YUC)	48*	2*	Klitgaard 2012
Flora of Western Mexico	AGU, COL and JAL, and small portions of DUR, GUA, MIC, NAY and ZAC	103	16	González-Gallegos *et al.* 2016
Flora of the Valley of Tehuacán-Cuicatlán	PUE and northern OAX	66	1	Martínez-Gordillo *et al.* 2019
Flora of the Bajío and Adjacent Regions	GUA, QUE, and northeastern MIC	67	6	Zamudio *et al.* in press

*These numbers correspond exclusively to those registered in Mexico.

Results

Salvia gomezpompae J.G.González & Bedolla, sp. nov. (Figure 1-2). Type. Mexico, Veracruz, municipality Las Minas: Romerillos, 7 km de Cruz Blanca por la carretera rumbo a Las Minas, 19° 40' 32.9'' N, 97° 9' 52.06'' W, 2,039 m elev., 12 December 2020, *J.G. González-Gallegos, S. Zamudio, B. Bedolla-García and J. Noriega-Villa 2527* (Holotype: CIIDIR; Isotypes: ANSM, BUAP, CHAP, CHAPA, EBUM, HUAA, IBUG, IEB, MEXU, OAX, QMEX, USON, XAL, XALU, ZEA).

Diagnosis. Species ad Salvias sectiones *Farinaceas* pertinentes, habitu et characteribus floralibus *Salviae oblongifoliae* similis, sed petiolis longioribus, foliorum immaturorum fasciculis axillaribus carentibus, foliorum laminae plerumque longis et constanter latis, nunc rhomboideis nunc oblongo-lanceolatis, pubescentibus, bullatis, subtus venis primariis et secundariis incrassatis differt.

Description. Subscapose perennial herb, (5.5-)15-35(-63) cm tall; roots with multiple ovoid to spheric tubercles usually tapering to the base; stems densely short pilose and puberulent, rarely also with some glandular-capitate. Leaves with petioles (0.6-)1.5-4.8 cm long, densely short pilose with a mix of simple and glandular-capitate hairs, sometimes tinged with purple; leaf blade rhomboid to oblong-lanceolate, 3.4-12.5 × 1.8-5.6 cm, apex acute to rounded, base cuneate to long attenuate, margin crenate, bullate above, both surfaces of the leaf blade short pilose with simple hairs, and sometimes also with glandular-capitate and puberulent, but the indumentum denser beneath, primary and secondary veins thickened and elevated beneath (some plants rarely with deltoid-ovate leaves, with petioles 0.5-1.5(-2.1) cm long, and leaf blade 2.1-5.5 × 2-4 cm, apex acute and base truncate). Inflorescence a spiciform raceme, (2.6-)8-28(-53) cm long, with (1-)3-9 verticillasters, each one 2-8 flowered, the lowermost (0.9-)2.7-5.2(-7.5) cm apart from each other; axis short hispidulous with tiny glandular-capitate hairs intermixed with simple ones, some few of these curled, especially between the ribs. Floral bract deciduous, lanceolate to ovate, 1.7-4.2 × 0.8-3 mm, apex acuminate to caudate, base truncate, margin entire, outer surface short pilose and with tiny glandular-capitate hairs, 7-veined. Pedicel 1.5-3 mm long, up to 3.1-4.5 mm in fruit, covered with tiny glandular-capitate hairs. Calyx 4.5-7 × 2-3 mm, up to 7.2-10 × 3.2-4.4 mm in fruit, dorsally tinged with purple, hispidulous with glandular-capitate hairs and sessile golden glandular dots, and puberulent, frequently also short pilose with the hairs along the veins, internally hispidulous in the front two thirds, both lips acute, the upper one (5)7-veined and entire. Corolla blue to purplish blue with the tube base white, and white nectar guides as a wide

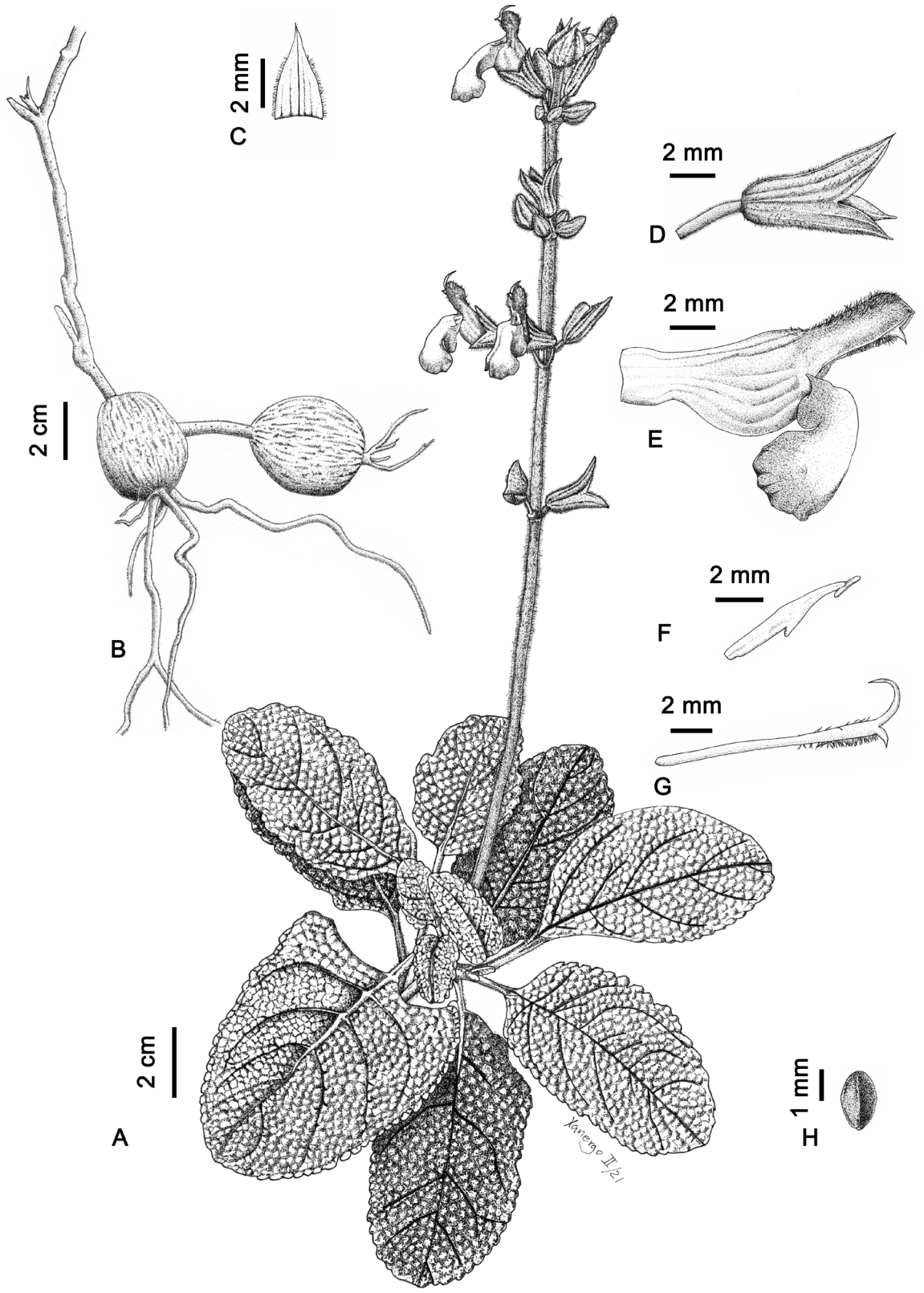

Figure 1. *Salvia gomezpompae* J.G.González & Bedolla. A) Habit, B) Portion of the root showing spheric tubercles, C) Floral bract (inner surface), D) Pedicel and calyx, E) Corolla, F) Connective and theca, G) Style, H) Mericarp (drawn based on the type collections).

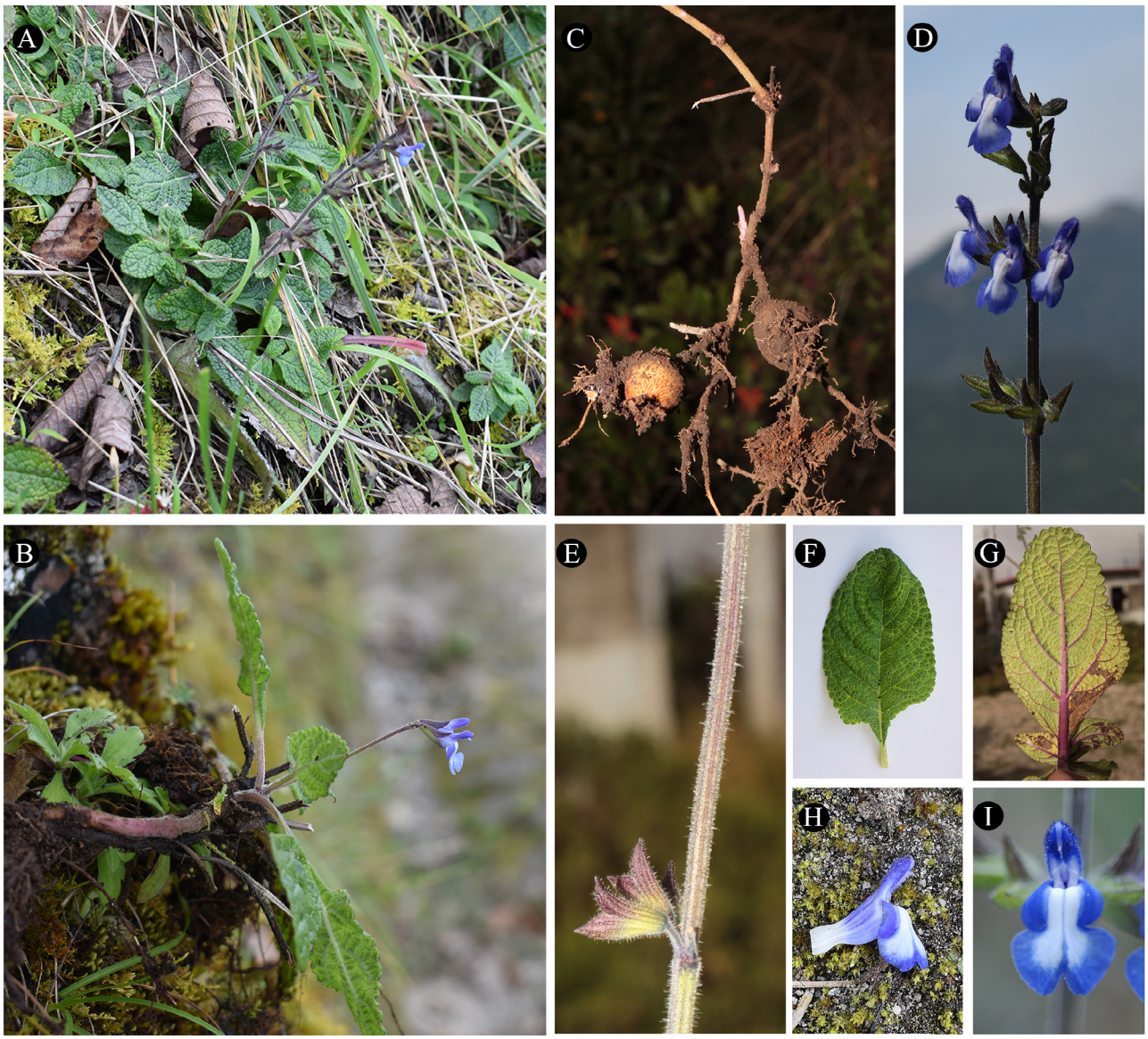

Figure 2. *Salvia gomezpompae* J.G.González & Bedolla. A) Habitat, B) General habit, C) Portion of the root with tubercles, D) Inflorescence, E) Detail of the pubescence of the rachis, F) Above leaf blade, G) Beneath leaf blade, H) Lateral view of the corolla, I) Frontal view of the corolla. Photographs taken by Arturo Castro-Castro (C, E & G); Brenda Bedolla-García (F); Jesús G. González-Gallegos (A, B, D & H), Sergio Zamudio (I).

brand covering almost whole central portion of the lower corolla lip, sparsely short pilose towards the lips and covered with sessile glandular dots; tube (5.8-)7-9.6 × 2.1-3.9 mm, slightly ventricose, straight at the base and internally epapillate; upper lip 2.4-4.7(-6) mm long; lower lip (2.7-)4.9-6.7 × (4.4-)5.2-7.6 mm, emarginate. Stamens inserted; filament 1.2-2.4 mm long, connective (4.4-)5-6.8 mm long, sometimes truncate at posterior end, ornate at midpoint ventral portion with an acute retrorse tooth; theca 0.8-1.4(-1.7) mm long; a pair of filiform staminodes above and behind filament insertion, frequently capitate at apex, 0.2-0.5 mm long. Gynobasic horn 0.5-0.7 mm long; style (7-)8.7-12.7(-15) mm long, pilose in the anterior portion along both dorsal and ventral line but with the hairs notoriously concentrated beneath (rarely glabrescent), upper stigmatic branch longer and arcuate, the lower one acute at apex. Mericarp ovoid, (1.6)1.8-2.3 × (8-)1-1.5 mm, dark bronze or black, surface glabrous and smooth.

Distribution, habitat and phenology. *Salvia gomezpompae* is known from two areas in the middle portion of the state of Veracruz, the southernmost in the municipality of

Acultzingo, and the other including neighbor localities in Las Minas, Las Vigas and Tatatila; both areas are relatively nearby the boundaries of the state of Puebla, so the species might eventually be found also there. It grows in pine-oak forests, occasionally with some cloud montane forest elements, in limestone or clay, from 1,700 to 3,140 m elevation. A collection from Las Minas is reported at 1,450 m, but that is most probably a mistake since the vegetation at that point does not match that of the specimen label, the point at that elevation is very close to the town Las Minas, and the coordinates are not precise. The new species share habitat with *Bocconia arborea*, *Pinus patula*, several species of *Quercus* and *Tilia mexicana*. It flowers and fructifies from the end of June to the beginning of December.

Conservation status. The two general areas inhabited by *Salvia gomezpompae* are separated by about 110 km. The southernmost is represented only by two close collections at the summit of the mountain Teoxistle, which are inside the southern border of Cañón of Río Blanco National Park; however, this NPA (Natural Protected Area) lacks even a program for its management and the information about it is scarce (CONANP 2021), so in practice being part of this area does not warrant to be subject to true conservation actions. In fact, that summit is dominated by secondary vegetation probably due to the construction maneuvers when establishing a microwave antenna at the top about 40 years ago. The other area is composed by five localities 1.6-6 km apart from each other, outside any NPA, though Cofre of Perote National Park is located 9-10 km to the South. The calculated EOO is 590.783 km^2, and the AOO, 24 km^2; hence, based exclusively on the distribution criterion the species would qualify as Endangered either by EOO or AOO, and as Vulnerable if number of locations is also considered [B1(a) and B2(a)] according to the IUCN (2019) guidelines. Nonetheless, intermediate populations that connect the currently known areas might be discovered in the near future, and no objective data on habitat fragmentation or population fluctuations are available at the moment, so it is still necessary to conduct further research to provide a well-supported conservation status of this species in the wild.

Etymology. The epithet is dedicated to Arturo Gómez-Pompa, prominent Mexican researcher, pioneer of the Flora of Veracruz project, founder of Tropical Ecology and Agroecosystems in Mexico, and discoverer of *Salvia divinorum* in the field in 1957 (*Gómez-Pompa 500-E*, GH; Reisfield 1993), the only psychoactive species in the genus.

Additional specimens examined.- Mexico, Veracruz, mun. Acultzingo: Cerro Teozintle [Teoxistle], 18 km al NE de Nicolás Bravo, 18° 40’ N, 97° 17’ W, 3,080 m, 17 October 1986, *P. Tenorio-L. and D. Frame 12018* (IEB, MEXU, XAL); Sierra de Zongolica, cima del cerro Teoxistle, 18° 40’ 24.33’’ N, 97° 13’ 51.85’’ W, 3,140 m, 11 October 2020, *J.G. González-Gallegos et al. 2489* (CIIDIR, IEB); mun. Las Minas: entre Cruz Blanca y Las Minas, 19° 42’ N, 97° 10’ W, 1,450 m, 12 July 1982, *F Vázquez-B. 645* (XAL); mun. Las Vigas: Las Vigas, 1,700 m, 25 June 1973, *M.J. Cházaro-B. and J. Dorantes 199* (MEXU); mun. Tatatila: Paraje El Bordo, entre Las Vigas y Tatatila, 14 August 1985, *M.J. Cházaro-B. & P. Padilla 3630* (MEXU); Tenepanoya, 19° 40’ N, 97° 8’ W, 1,800 m, 25 October 1988, *C. Duran and P. Burgos 704* (XAL); La Mancuerna, 19° 41’ 14.08’’ N, 97° 8’ 4.73’’ W, 2,130 m , 28 October 2016, *A. Alarcón et al. 27* (XAL).

Discussion

The floral characters exhibited by the new species clearly match those of *Salvia* subgenus *Calosphace* according to the diagnostic character compilation presented by González-Gallegos *et al.* (2020a). Following Epling’s (1939) identification key to the sections of this subgenus leads to a couplet contrasting the sections *Farinaceae* (Epling) Epling and *Flocculosae* (Epling) Epling. These sections are distinguished in the key by subtle differences on calyx indument which do not really allow an unambiguous separation (calyces appressed-hirtellous *vs*. covered with extended short hairs, and frequently with glands; respectively). However, most species in *Flocculosae* are short shrubs adapted to arid environments and with branched hairs on the stems and/or on the calyx, possessing leaves at most up to 3 cm long, and styles pubescent only on the dorsal line (Epling 1939, Turner 2013). In contrast, *Farinaceae* comprises mostly perennial herbs, variable in ecological affinities but most inhabiting temperate areas, none of the species with branched hairs, leaves variable in size but the majority exceeding 3 cm long or if not, then elliptic to linear, and the styles pubescent along both dorsal and ventral lines, though the hairs sometimes denser in one of these sides (Epling 1939, Peterson 1978, Turner 2008, González-Gallegos & Castro-Castro 2012, González-Gallegos 2015). Hence, the new species better fits into *Farinaceae* circumscription, and consequently it is assigned to this group. Nonetheless, this assignation is

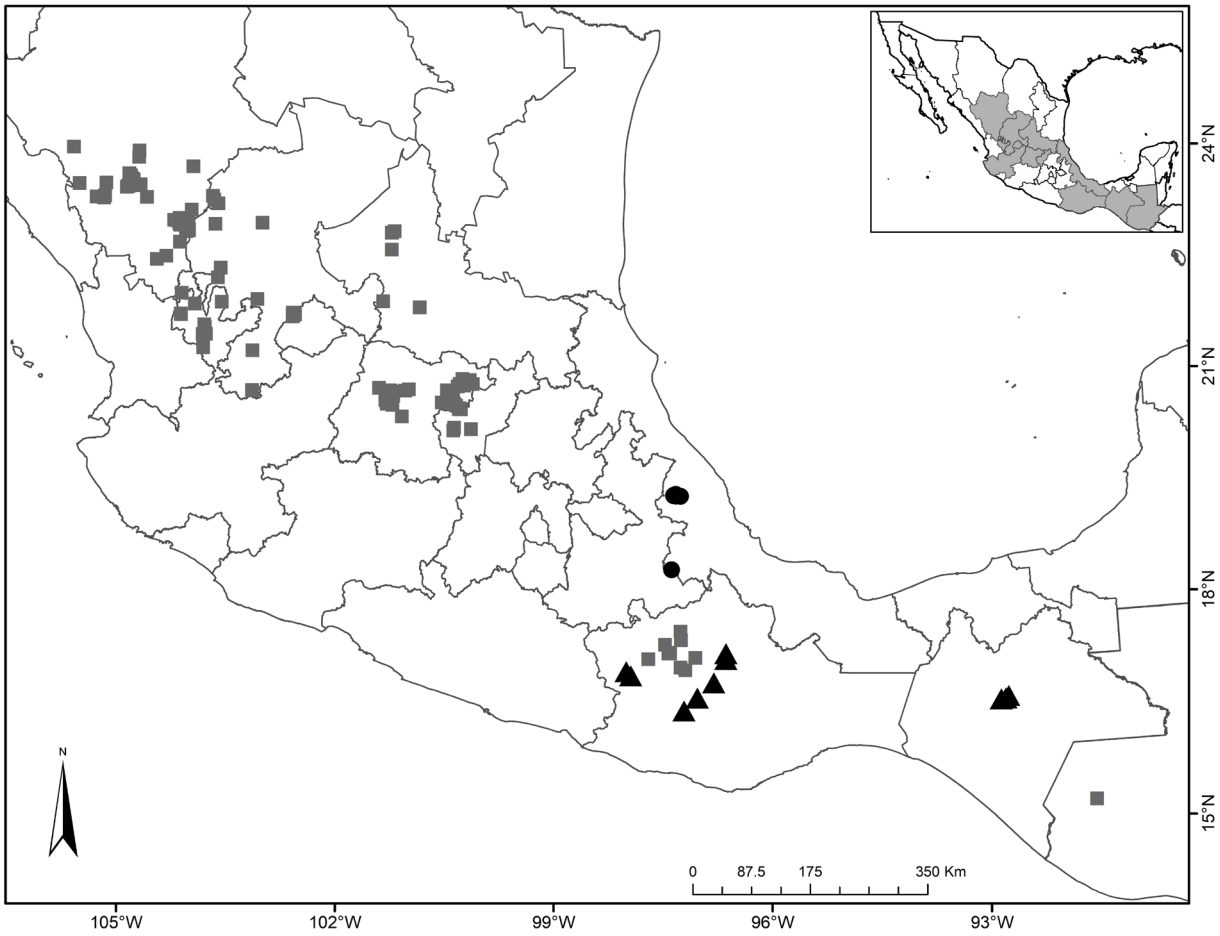

Figure 3. Distribution map of *Salvia gomezpompae* (circles), *S. nana* (squares) and *S. oblongifolia* (triangles).

provisional since this section has not been recovered as monophyletic (Jenks *et al.* 2013, Fragoso-Martínez *et al.* 2018, Kriebel *et al.* 2019). In Kriebel *et al.* (2019) 8 of 20 species currently recognized in the section (González-Gallegos *et al.* 2020a) were included, being recovered in three different clades and intermixed with species of sections *Angulatae* Epling, *Coerulea* Epling, *Flocculosae* (Epling) Epling, *Malacophyllae* Epling and *Pennellia* Epling. However, until now no natural classification has been proposed for rearranging *Calosphace* species into natural sections, it is still necessary to increase species representation in phylogenetic analysis to allow the restructuring of the sectional classification in subgenus *Calosphace*.

Among the species of *Salvia* sect. *Farinaceae*, *S. gomezpompae* is morphologically most similar to *S. oblongifolia* M.Martens & Galeotti. Both species share a similar habit being perennial herbs with the leaves basally clustered (more markedly in *Salvia gomezpompae*) and hence appearing subscapose, ascending from a woody rootstock and of similar size; also, floral characters are similar with a significant overlap in quantitative ones such as pedicel length, calyx and corolla tube size, upper corolla lip length and lower corolla lip size, and connective and style length (Table 2). However, *S. gomezpompae* differs in having longer petioles ((0.6-)1.5-4.8 *vs.* 0.2-1.5 cm), absence of fascicles of undeveloped leaves in leaf axils, usually longer leaf blades (3.4-12.5 *vs.* (1-)2-3.5(-5)), these consistently wider (1.8-5.6 *vs.* (0.2-)0.5-1.5) and of a different shape (rhomboid to oblong-lanceolate *vs.* linear, lanceolate to elliptic-obovate or elliptic-rhomboid) and pubescence (short pilose with simple hairs and sometimes also with glandular-capitate and puberulent *vs.* glabrous), bullate leaves above (*vs.* smooth), thickened and elevated veins beneath the leaf blade (*vs.* only primary vein thickened and elevated towards the base and the rest slightly impressed) (Table 2). Furthermore, the new species produces ovoid or spher-

Table 2. Comparison of relevant taxonomic characters in *Salvia* between *Salvia* sp. nov. and the morphologically most similar species. Distribution and habitat information is also compared. Data for *S. nana* and *S. oblongifolia* were taken from González-Gallegos *et al.* 2016, and Epling (1939) and Peterson (1978), respectively. The latter was also complemented by examination of type specimens at Jstor Global Plant webpage, and additional herbarium specimens. Mexican states and Guatemalan departments are abbreviated according to the code ISO 3166-2.

Character	*Salvia gomezpompae*	*Salvia oblongifolia*	*Salvia nana*
Habit	perennial herb, ascending from a woody rootstock and ovoid to spheric tubercles usually tapering to the base, stem 5-12 cm long	perennial herb, ascending from a woody rootstock, stem 18-22 cm long	perennial herb, erect from a woody rootstock and ovoid to spheric tubercles usually tapering to the base, acaulescent (rarely with a stem up to 7 cm, but the leaves still compact in a rosette)
Height (cm)	(5.5-)15-35(-63)	30-60	8-35(-45)
Stem pubescence	short pilose and puberulent, rarely also with some glandular-capitate hairs	short pilose and puberulent with simple hairs	if present, short pilose and puberulent
Petiole length (cm)	(0.6-)1.5-4.8	0.2-1.5	0-2
Leaves distribution	basally clustered but with visible internodes, without fascicles of undeveloped leaves in leaf axils	clustered to the first basal third of the plant with internodes as long or longer than the leaves, with several fascicles of undeveloped leaves in leaf axils	clustered into a basal rosette (i.e., lacking internodes of these extremely reduced), without fascicles of undeveloped leaves in leaf axils
Leaf shape and size (cm)	rhomboid to oblong-lanceolate, 3.4-12.5 × 1.8-5.6	linear, lanceolate to elliptic-obovate or elliptic-rhomboid, (1-)2-3.5(-5) × (0.2-)0.5-1.5	ovate, oblong-ovate, rhombic-elliptic to obovate, (2-)3-9.2 × 2.3-4(-7)
Shape of the leaf apex, base and margin	acute to rounded; cuneate to long attenuate (partially decurrent along the petiole); crenate	obtuse; attenuate (partially decurrent along the petiole); crenate-serrate	rounded to obtuse or acute; cuneate to abruptly attenuate (decurrent along the petiole); crenate to serrate
Leaf pubescence	short pilose with simple hairs, and sometimes also with glandular-capitate and puberulent in both surfaces	glabrous in both surfaces	sparsely pilose, also with appressed hairs, and puberulent to glabrescent above, moderately pilose along the veins or even between them to tomentose beneath
Leaf surface	above bullate, beneath primary and secondary veins thickened and elevated	above smooth, beneath primary vein thickened and elevated only towards the base, the rest slightly impressed	above bullate, beneath primary and secondary veins thickened and elevated

Character	*Salvia gomezpompae*	*Salvia oblongifolia*	*Salvia nana*
Inflorescence length (cm)	(2.6-)8-28(-53)	7-30	10-33(-55)
Floral axis pubescence	short hispidulous with simple and glandular-capitate hairs	short hispidulous covered with tiny glandular-capitate and simple hairs	short hispidulous with simple and glandular-capitate hairs, some plants without glandular hairs
Number of flowers per verticillaster	2-8	(2-)4-12	(2-)6-12
Floral bract duration	deciduous	deciduous	deciduous
Floral bract shape and size (mm)	lanceolate to ovate, 1.7-4.2 × 0.8-3	lanceolate to ovate, 4-4.4 × 1-2.5	ovate, 3.2-5(-8) × 1.5-5
Pedicel length (mm)	1.5-3	1-3	0.9-2.1
Flowering calyx shape	tube straight and longer than the lips; upper calyx lip entire at apex	tube straight and longer than the lips; upper calyx lip entire at apex	tube divergent as the lips, and shorter than these; upper calyx lip trimucronate at apex
Calyx size (mm)	4.5-7 × 2-3	6-8 × 2-4	3-6 × 2-4(-6)
Number of veins on the upper calyx lip	(5)7	7	(5)7
Calyx pubescence	hispidulous with glandular-capitate hairs, puberulent and frequently also short pilose along the veins	short pilose with simple and glandular capitate-hairs, dispersed throughout the surface	short pilose with glandular-capitate hairs along the veins and the margin, covered with sessile glandular dots (visible to the naked eye) orange to dark ochre with age, some plants without glandular hairs
Corolla color	blue to purplish blue with the tube base white, and white nectar guides as a wide brand covering almost whole central portion of the lower corolla lip	blue to purplish blue with the tube base white, and white nectar guides as a wide brand covering almost whole central portion of the lower corolla lip	blue or bluish violet, pale pink to magenta, with the tube base white, and white nectar guides as several thin lines (2-4), not covering the central portion of the lower corolla lip
Corolla tube size (mm)	(5.8-)7-9.6 × 2.1-3.9	6.7-10 × 2.2-3	4.7-5(-8.5) × 3-3.2
Upper corolla lip length (mm)	2.4-4.7(-6)	3-5	3-5
Lower corolla lip orientation	deflexed and perpendicular to corolla central axis	deflexed and perpendicular to corolla central axis	slightly deflexed and almost parallel to corolla central axis (opening between the lips at most 20º)

Character	*Salvia gomezpompae*	*Salvia oblongifolia*	*Salvia nana*
Lower corolla lip size (mm)	(2.7-)4.9-6.7 × (4.4-)5.2-7.6	5.4-8 × 6.3-7.8(-9)	6.5-9(-11) × 4.2-8.6
Connective length (mm)	(4.4-)5-6.8	5-7	4-5(-7)
Connective ornamentation	a retrorse acute tooth at ventral midpoint	a retrorse acute tooth at ventral midpoint	an antrorse oblong plate with the tip retrorse at ventral midpoint, resembling a half stirrup
Style length (mm), outline and pubescence	(7-)8.7-12.7(-15), almost with the same width throughout, pilose at apex along both dorsal and ventral portion but with the hairs concentrated beneath (rarely glabrescent)	11-12, almost with the same width throughout, pilose at apex along both dorsal and ventral portion but with the hairs concentrated beneath	7-8(-12), widened towards the apex, densely pilose in the dorsal side including the base of the upper stigmatic branch
Distribution	endemic to eastern Mexico (VER)	endemic to southeastern Mexico (CHP and OAX)*	from central-northern Mexico (AGU, DUR, GUA, JAL, OAX, PUE, QUE, SLP and ZAC) to Guatemala (HU, QZ, SM)
Habitat	pine-oak forest, sometimes with elements from cloud montane forest, 1,700-3,140 m	oak-pine forest and pine forest, 2,500-3,800 m	oak forest, pine-oak forest, pine forest, grassland, xerophytic scrub or secondary vegetation derived from one of the above, (1,900-)2,100-2,750 m

*Klitgaard (2012) cited the presence of *Salvia oblongifolia* in Guatemala based on *Steyermark 51751* (F); however, this specimen rather belongs to *S. reptans* Jacq. At the same time such specimen seems to be used to complement the description presented in *Flora Mesoamericana*, hence, the description therein was not considered.

ic tubercles additional to the central woody rootstock, whereas it seems that those produced by *S. oblongifolia* are narrow napiform; however, most of the specimens of this species lack root structures.

Moreover, it is striking that vegetatively the new species is very similar to *Salvia nana* Kunth and *Salvia prunelloides* Kunth from *Salvia* sect. *Uliginosae* (Epling) Epling. In fact, several of the specimens were misidentified under either of those names and probably it is one of the reasons, which explains why the species remained unnoticed for so long. This is outstanding considering that there were available several collections (the oldest from 1973) and most of the localities are close to Xalapa, headquarters of INECOL, one of the Mexican institutions with the longest standing tradition on botanical studies. Particularly, the new species and *Salvia nana* look almost identical compared only based on vegetative characters. The similarity between this and the new species is given by having a thickened rootstock accompanied frequently with ovoid or spheric tubercles, leaves clustered towards the base, being even basal or almost basal in *S. nana*, general shape and outline of the leaves (apex, base and margin), leaf surface texture (bullate), thickness of primary and secondary veins beneath, and pubescence of the leaves (Figures 1-2, 4-5, Table 2). Nonetheless, *Salvia gomezpompae* does not present the morphological characters that would place it within *Uliginosae*, and hence the membership into this group is discarded as well as the affinity

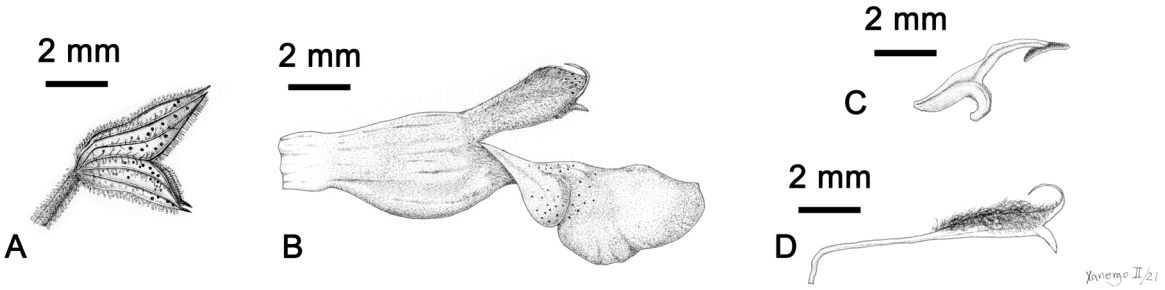

Figure 4. *Salvia nana* Kunth, illustration of floral characters. A) Calyx, B) Corolla, C) Connective and theca, D) Style (drawn based on *Rzedowski 48792*, CIIDIR).

with either *S. nana* or *S. prunelloides*. The species in *Uliginosae* are notorious by having calyces densely covered with sessile glandular dots, calyx tube and lips divergent in outline, and these as long or longer than the tube itself, upper calyx lip trimucronate in most of the species, upper corolla lip usually with sessile glandular dots, connective geniculate, widened style in a dorsoventral plane towards the apex, and a dense tuft of hairs just before the stigmatic branches, oriented to one side (Epling 1939, Turner 2009, Figures 4-5). It is worth noting that, though *Salvia galloana* B.L.Turner was assigned to *Uliginosae* (Turner 2009), it does not present the diagnostic characters of the section and has not been recovered in the same clade according to Fragoso-Martínez *et al.* (2018). Additionally, the lower corolla lip in *Salvia gomezpompae* is deflexed and perpendicular in respect to central corolla axis, and the nectar guides consist of a wide brand covering almost the whole central portion of the lip. In contrast, in *S. nana* the lower corolla lip is parallel to the central axis, with an opening angle in respect to the upper corolla lip no higher than 20º and the nectar guides are composed by several thin lines that do not cover the central portion of the lip (Figures 2, 5; Table 1).

The morphologically most similar species to *Salvia gomezpompae*, *S. nana* and *S. oblongifolia*, also marginally differ in distribution (Figure 3). Although these are also present towards southern Mexico, neither of them grows in Veracruz (Table 1). *Salvia nana* had been previously registered from Veracruz (González-Gallegos *et al.* 2016, 2020a, Martínez-Gordillo *et al.* 2017), but we were not able to find any specimens to corroborate this in IEB, MEXU and XAL herbaria which are the collections with a better representation of the flora of this state. The presence of this species in the state might have been recorded exclusively based on the misidentified specimens of *S. gomezpompae*.

It is also remarkable that the identification confusion between *Salvia gomezpompae* and *S. nana* has transcended the taxonomic scope into the horticultural trade. When preparing this article and consulting different sources on the internet, we were astonished to find photographs of plants being commercialized, or promoted by landscape or gardening consultants and collectors, as either *S. nana* or the cultivar *S. nana 'Curling Waves'*, but looking rather like the new species we were working on (Table S2). In order to clarify this situation, plants in cultivation by Rolando Uría corresponding to *Salvia nana* with accession number BSWJ10272, and coming from the nursery Crûg Farm Plants (2021; https://www.crug-farm.co.uk/s-53.aspx), were examined. Once analyzed, it was clear that floral morphology of these plants in cultivation (Figure S1) did not correspond to that so distinctive of *Salvia* sect. *Uliginosae* (compare with floral details of the true *S. nana* in Figure 4), and hence, it was confirmed that the identification as *S. nana* was a mistake and that these plants actually belonged to *S. gomezpompae*. The plants identified as *Salvia nana* BSWJ10272 were introduced to the market by the nursery Crûg Farm Plants (2021) in the United Kingdom after a collecting expedition in Mexico in 2004 by Bleddyn Wynn-Jones and Sue Wynn-Jones (the accession number can be tracked on the list of expeditions addressed by the nursery in the following link: https://www.crug-farm.co.uk/plant_hunting-3.aspx). Most probably the cultivar *'Curling Waves'* was established based on the former plants, since there are not significant morphological differences between them. It is worth noting that this cultivar is patented claiming and hybrid origin (Patent Number: US PP23,932 P2, September 24, 2013), but with no specification of the parental species, it is just mentioned as origin of the cultivar: "Unnamed, unpatented *Salvia* plants were crossed during the Summer of 2007". However, in

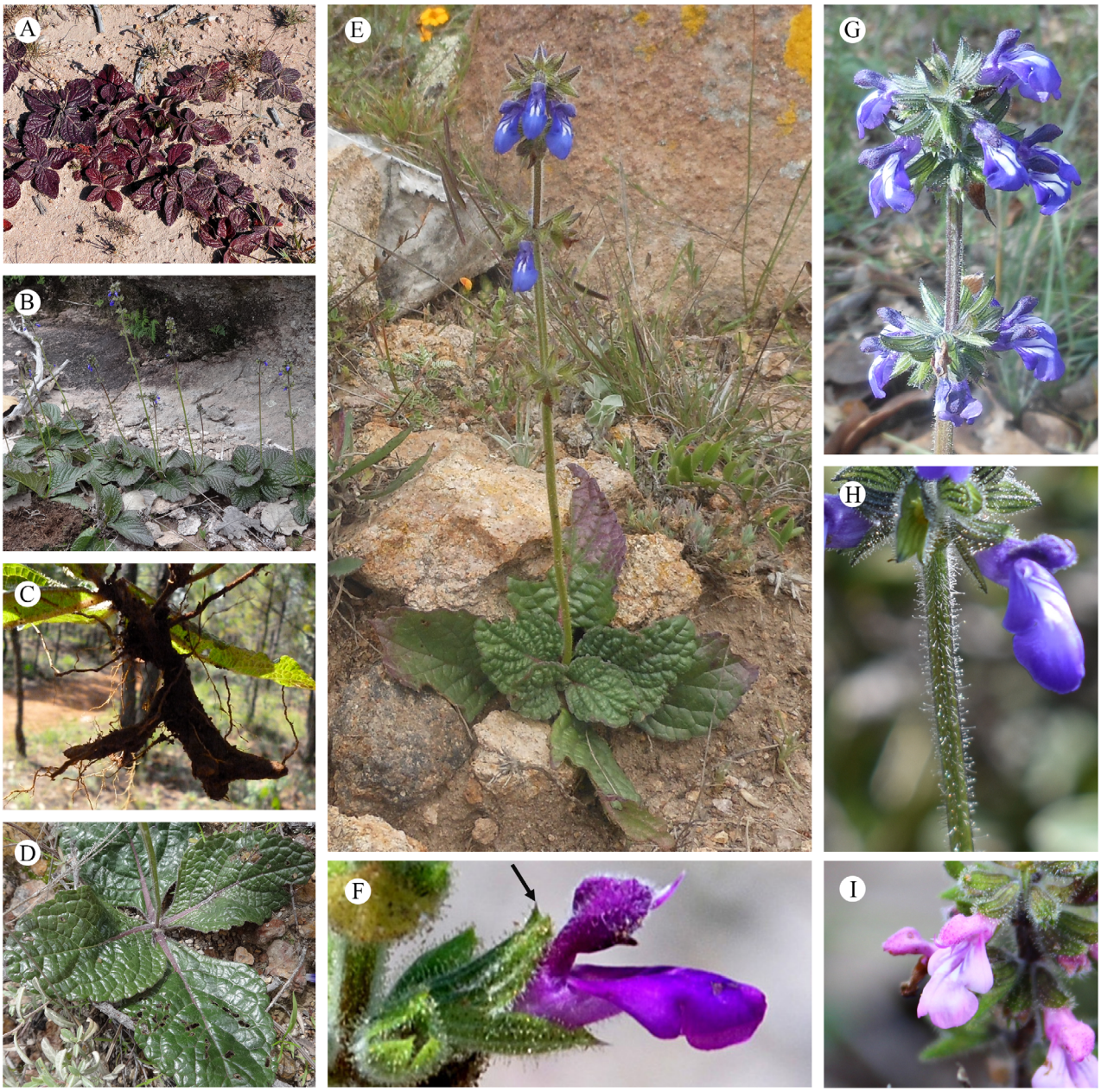

Figure 5. *Salvia nana* Kunth. A-B) Habitat and variation in leaf color, C) Tuberculated root, D) Leaves compact into a rosette, E) General habit, F) Lateral view of the calyx and corolla, the arrow indicates the trimucronate upper calyx lip, G) Inflorescence, H) Detail of the pubescence of the rachis, E-I) These captures also show variation in corolla color, blue or bluish violet, pale pink to magenta. Photographs taken by Esteban Guerrero (I); Jesús G. González-Gallegos (B-D & H); Sergio Zamudio (A & E-G).

face to the current evidence on the matching morphology among this cultivar, the plants introduced by Crûg Farm Plants and *S. gomezpompae*, it is evident the three belong to the same species, and hence during patenting process of the cultivar *'Curling Waves'* the identification confusion with *S. nana* could have played a major role.

This situation exemplifies the complexity in patenting natural resources and the vulnerabilities of the process through its laxity and ethical violations. Although the Nagoya Protocol (Secretariat of the Convention on Biological Diversity 2011), an instrument of the Convention on Biological Diversity (CBD 2021), claims for

a fair and equitable sharing of benefits from the use of genetic resources between the participant countries (usually the country of origin of the species, and the other, that in which the species is subjected to a genetic modification) putting this in practice and regulating it is extremely difficult. In this particular case, it results obscure how it is possible that a plant is allegedly declared as a hybrid and patented without pointing out the parent species, and even so it is stated that those unnamed parental plants are unpatented, this cannot be assured when the names are not even known. Due to the above, setting up stricter and more transparent and ethical rules would prevent patents from being granted over genetic resources, and would allow possible disqualification of patents, when not complying with CBD obligations. The problem goes further, because systematics and taxonomy itself are those who provide the scientific background to judge the authenticity of new cultivars and to bind them with their wild parents or natural source. But, those scientific disciplines are suffering under the so called taxonomic crisis, which consists mainly in a progressive reduction on academic interest, financial support, number of taxonomists and alive biological collections (Agnarsson & Kuntner 2007, Wheeler 2014, Villaseñor 2015). So, Nagoya Protocol will hardly work effectively as long as the number of professionals able to identify and describe biological diversity, and the biological collections in which their work depends, keep declining, because it is not possible to regulate the management of what it is unknown. This is especially true for highly biodiverse countries like Mexico, in which a considerable number of species remain to be discovered and named (Martínez-Meyer *et al.* 2014).

Acknowledgments

We are grateful to Luis Rey Flores for editing Figures 1 & 5. We also appreciate the support provided by Arturo Castro-Castro, Sergio Zamudio and Jorge Noriega Villa for participating in the collection of plants, and by sharing some of their photographs. The first author thanks the financial support provided by CONACyT by means of the project CB-2015-01-255165 Sistemática, filogenia y biogeografía del género *Salvia* L. (Lamiaceae) en México. This study was supported by the Consejo Nacional de Ciencia y Tecnología (CONACyT) to Brenda Bedolla-García through the Sistema Nacional de Investigadores (SNI) (80655). We appreciate the observations made to the text by Cynthia M. Núñez-Núñez and two anonymous reviewers, which helped to improved it.

Supplementary material

Supplemental data for this article can be accessed here: https://doi.org/10.17129/botsci.2889

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Associate editor: Martha Martínez Gordillo

Author contributions: JGGG and BYBG contributed equally to the planning and execution of the present research, including field work, specimen examination, data analysis and writing; RU participated in data analysis and writing, particularly helping in untangling the true identification of the purportedly *Salvia nana* in cultivation.